
Space Weather Technical Forecast

Issued on Thursday, 25 July 2024 at 01:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of R1 Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has remained Moderate, with two M flares in the past 24 hours, with peak M3.6 flare observed at 24/0742 UTC. There are currently eleven sunspot regions on the solar disc. The two closely residing spots in the southwest have continued a slow decay, AR3751 has simplified, losing its gamma configuration, and AR3761 has shown some fading of trailing spots. AR3762 in the southwest approaching centre disk, is the largest and most complex spot, exhibiting proliferation in intermediate spots, with perhaps a tenuously weak delta spot present here alongside the well established delta in the trailing region. AR3766 and the new region are two small and simple groups which have recently become evident near the eastern limb. All other remaining regions are small or simple.

No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, indicated waning effects of a weak CME which arrived 23/1950 UTC. Speeds remained slow throughout, 280-360 km/s. Density trended from around average to below average. The interplanetary magnetic field (IMF), Bt, was briefly strong at first (18nT) then mostly moderate to weak on a declining trend. The important north-south component, Bz, was almost entirely positive (northward), peaking +11nT early in the period. The phi angle was entirely negative (Towards the Sun). The net result of the above solar wind measures was for Quiet (Kp 1-2) geomagnetic indices.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 has returned back to background levels after a period above S1 during 23 Jul following a large far sided full halo CME. High energy electron flux (greater than 2MeV) observed at GOES16 was at Normal Background. The 24-hour fluence was well below Active, with 1.06e6 integrated pfu observed at 25/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of further M-class flares.

Solar Wind /Geomagnetic Activity: No coronal hole fast winds feature in the forecast period. There are up to two CMEs possible in the period. The first would be a very late arrival of the full halo CME from 21 July, but any impacts are likely to be weaker than previously anticipated. The second was from a long period M2.4 flare close to the southeast limb on 23 Jul, with low confidence of peripheral glancing impacts at Earth possible either late on day 2 or early day 3 (26/27 Jul).

Geomagnetic activity is expected to remain Quiet to Unsettled throughout. There is a chance of Active intervals and a slight chance of G1/Minor storms should either CME arrive between days 1-3 (25-27 Jul).

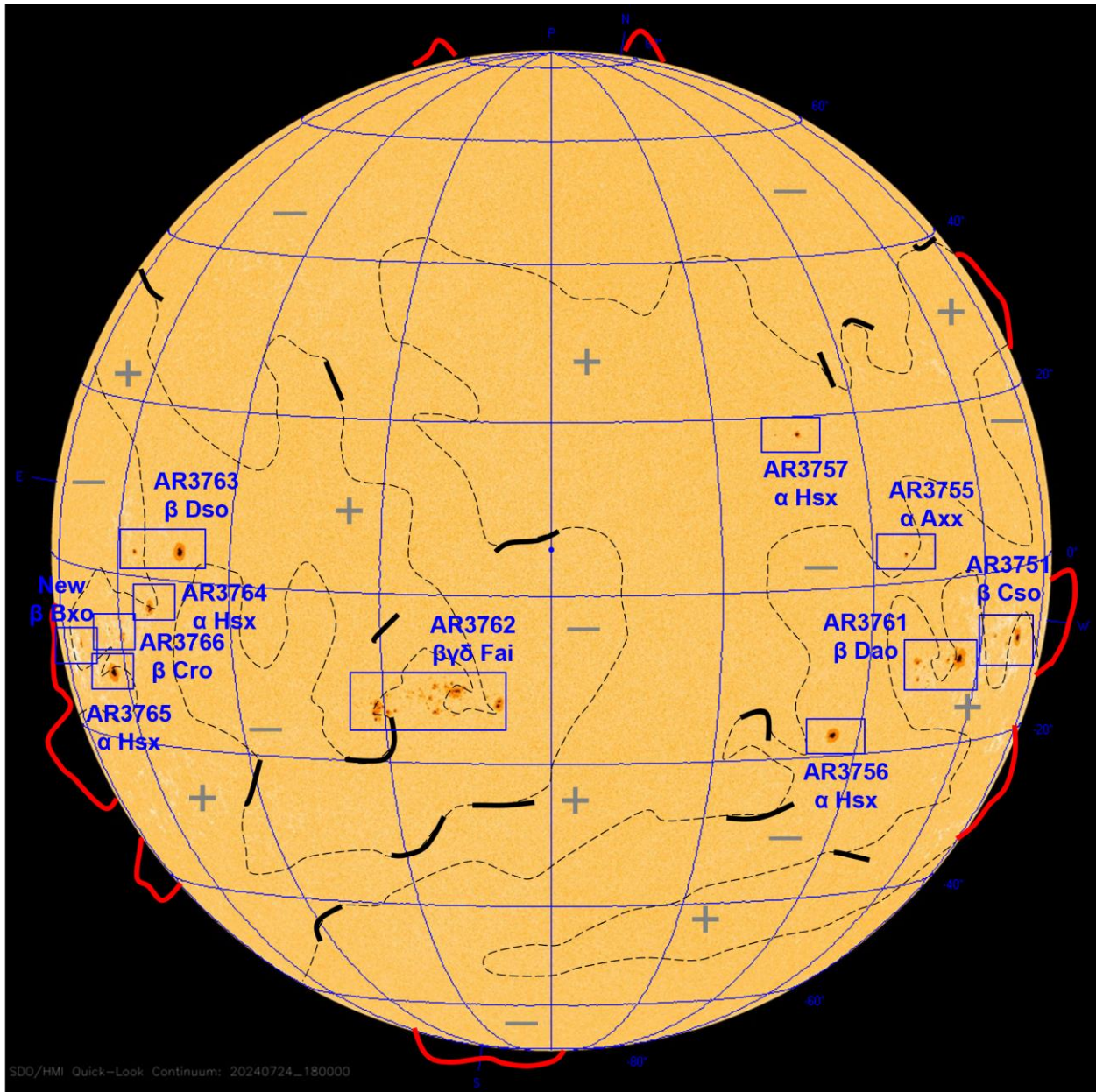
Energetic Particles / Solar Radiation: High energy proton levels are likely to remain at background levels, although there is a slight chance of reaching the S1 threshold if any notable

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flares occur throughout the remainder of the period.

The high energy electron flux is expected to persist at normal background levels, given no notable changing events have occurred recently or are expected. Electron fluence levels are therefore expected to remain below the Active (1e8 pfu) threshold.

Figure 1. Solar Analysis Valid 24/1800 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No coronal hole fast winds feature in the forecast period. There are up to two CMEs possible in the period. The first would be a very late arrival of the full halo CME from 21 July. A very weak CME arrival was evident from 23/1950 UTC, but speeds within this event are contrary to what was expected. As such, there remains a slight chance of an arrival at Earth during day 1 (25 July), but any impacts are likely to be weaker than previously anticipated.

The second CME was from a long period M2.4 flare close to the southeast limb near AR3764 at 23/1430 UTC. This gave a wide and moderately fast CME, perhaps with low confidence of peripheral glancing impacts at Earth possible either late on day 2 or early day 3 (26/27 Jul).

Geomagnetic activity is expected to remain Quiet to Unsettled throughout. There is a chance of Active intervals and a slight chance of G1/Minor storms should either CME arrive between days 1-3 (25-27 Jul).

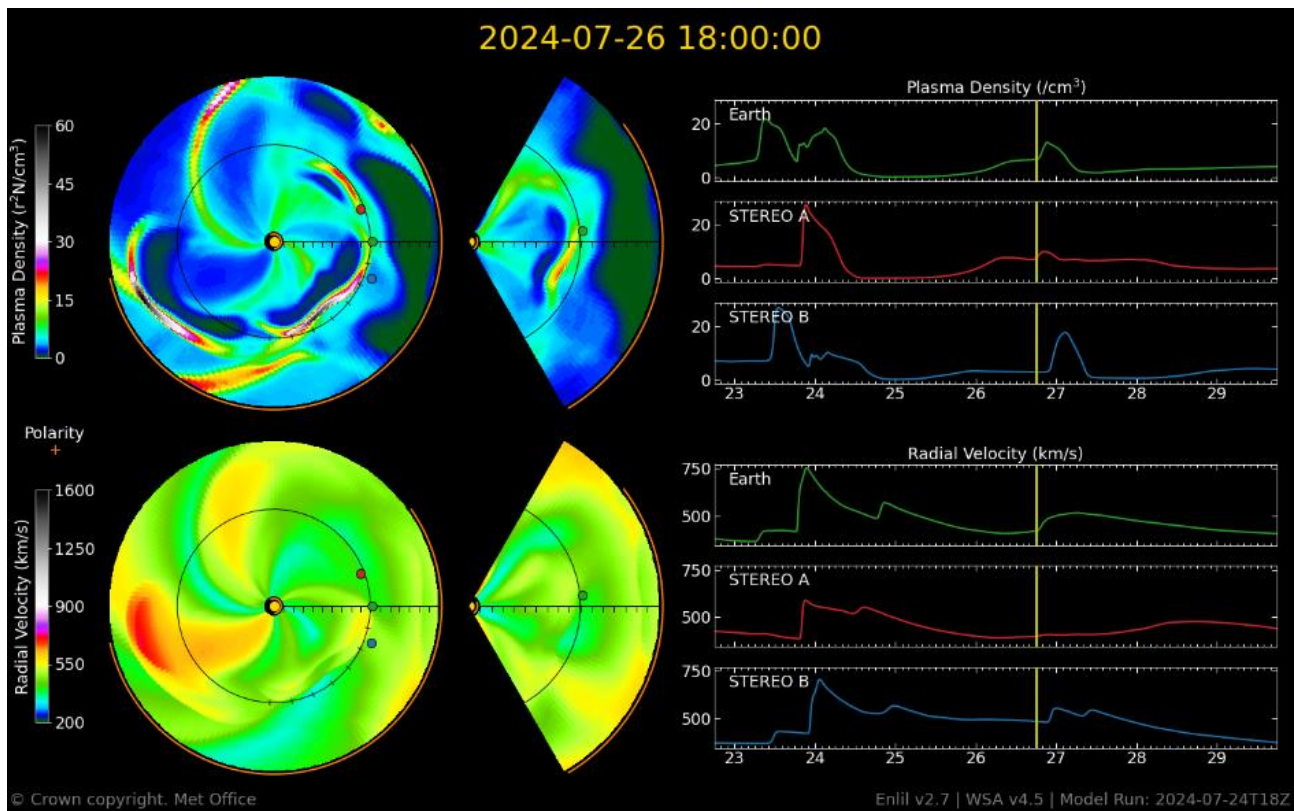
Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	20	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
21/1629	Full	Filament Eruption	NE	1050 km/s	24/0300 UTC +/- 9 hours	Likely
23/2224	Partial	M2.4	SE	560 km/s	26/1500 UTC +/- 12 hours	Low confidence due to location. Shock most probable.

Figure 2: MOSWOC ENLIL

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Radio Blackouts - X-Ray Flares:

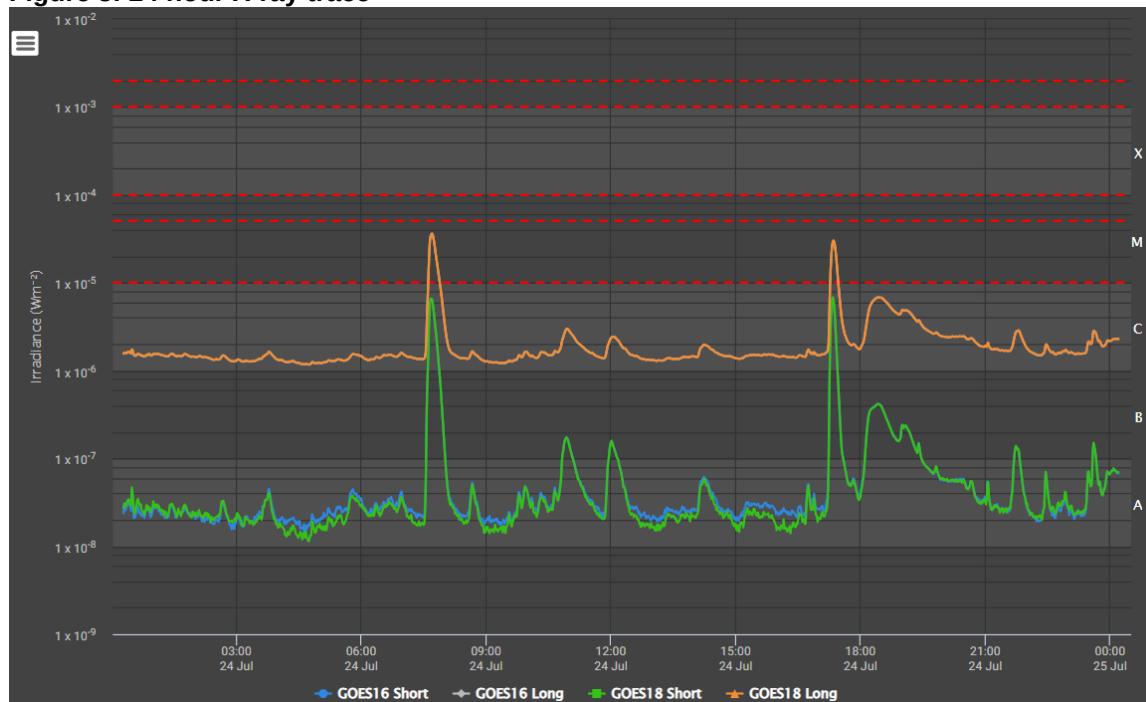
Activity has remained Moderate, with two M flares in the past 24 hours, with peak M3.6 flare observed at 24/0742 UTC.

There are currently eleven sunspot regions on the solar disc. The two closely residing spots in the southwest have continued a slow decay, AR3751 has simplified, losing it's gamma configuration, and AR3761 has shown some fading of trailing spots. AR3762 in the southwest approaching centre disk, is the largest and most complex spot, exhibiting proliferation in intermediate spots, with perhaps a tenuously weak delta spot present here alongside the well established delta in the trailing region. AR3766 and the new region are two small and simple groups which have recently become evident near the eastern limb. All other remaining regions are small or simple.

Activity is expected to be Low to Moderate with a chance of further M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: 24 hour X-ray trace



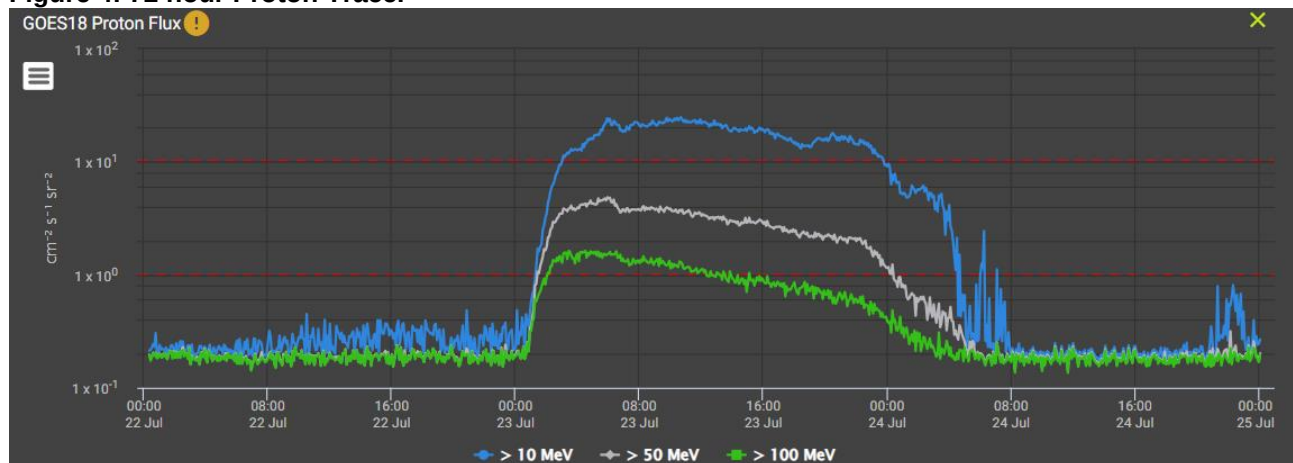
Solar Radiation Storms - (High Energy Protons):

Proton levels have returned back to background levels. High energy proton levels are likely to remain at background levels, although there is a slight risk of reaching the S1 threshold if any notable flares occur throughout the remainder of the period.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	Yes	10	10	10	10
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

Figure 4: 72 hour Proton Trace.



High Energy Electrons Event ($\geq 2\text{MeV}$):

The high energy electron flux as observed by GOES16 is currently at Normal Background and is expected to persist at this level given no notable changing events have occurred recently or are expected.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	1
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 5: MOSWOC REFM fluence forecast/observations/recurrence

